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Reminiscence and Gestalt Theory

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REMINISCENCE AND GESTALT THEORY

By

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ORIENTATION

Since the phenomenon of reminiscence was first noted by Henderson (8) in 1903 there has been increasing interest in, and investigation of its occurrence. The critical analyses of the studies of reminiscence by McGeoch (11) and by Bunch and Magsdick (3) indicate that the several investigations yield non-comparable findings and conflicting conclusions. These surveys of the experimental studies of the phenomenon clearly demonstrate that the conditions under which reminiscence appears have been very incompletely worked out and that we know little more than that the phenomenon does appear.

Reminiscence is defined by McGeoch (11) as "The improvement in recall of incompletely learned material after an interval of time without intervenient formal learning or review." This definition has been adopted in this paper since it embodies the salient characteristics distinguishing reminiscence from other phenomena of retention.

The literature suggests several theoretical explanations for the phenomena of reminiscence. The theory of psychical dispositions, developed by Stout (13), proposes that every experience, after it is over, leaves behind it a condition upon which its revival depends. This condition is called a psychical disposition. The dispositions resulting from the accumulation of experience tend to form into systems of various degrees of complexity, and when any one of these systems is excited it becomes the content of consciousness. It is also assumed that the degree of excitability of a disposition is increased only by actually exciting it, and

that the excitement of a disposition does not cease when it is not in consciousness but continues in a lower or modified form for some time. It is further assumed that when part of a system of dispositions is excited the whole system tends to be excited in the same manner and degree. According to this theory, reminiscence is to be explained as due to the propagation of the excitement from part of a system to the whole system. At the time of the immediate recall part of the already existing system of dispositions is excited and becomes the content of consciousness and during the interval between the first and second recalls this excitement continues in a modified form, spreading to the other parts of the system. At the time of the second recall these other parts of the system of dispositions are sufficiently excited to become the content of consciousness and appear as reminiscent material.

The major criticism of the theory, as far as this paper is concerned, is that it sets up no criterion by which to distinguish between dispositions which become effective and those which do not. Since all of the material available for reminiscence does not appear as reminiscent material, the theory, to explain reminiscence adequately, must differentiate between the relative effectiveness of dispositions, since this relative effectiveness will determine whether or not they shall appear in reminiscence.

The fatigue theory proposes that the appearance of reminiscence is the result of decreased fatigue which was the result of the learning and present at the immediate recall. It is assumed that the mind is too fatigued to do itself justice at the time of the immediate recall but that at the time of the second recall it has recovered from this fatigue and the appearance of reminiscent material results. If this theory applied it would be expected that the longer the time spent in learning the greater would be the resulting fatigue and therefore the greater the reminiscence upon recovery at the time of the second recall. Experiments conducted by Ballard (1) do not show this to be true. Ballard demonstrates other weaknesses of the theory as it is applied to the explanation of the appearance of reminiscence.

Somewhat similar to the fatigue theory, the theory of retroactive inhibition accounts for reminiscence in terms of the passing away of the disability imposed by the subsequently learned upon the previously learned. According to this theory, if a series of items is learned, those at the beginning of the list would be most affected by retroactive inhibition and should therefore show the greatest reminiscence. Ballard investigated this possibility and demonstrated that reminiscence is evenly distributed over the items of a partially learned series. He also demonstrates that most of the objections raised against the fatigue theory hold with equal force against the theory of retroactive inhibition as an explanatory theory of reminiscence. Koffka (10, pp. 490-492), in discussing the application of the theory of retroactive inhibition to other memory phenomena, shows that it is unnecessary to introduce it as an explanatory theory since what it was introduced to explain can be explained by more fundamental principles.

A theory of neural growth, also offered as explanatory of the phenomenon of reminiscence, assumes that some modification of the brain, originating during the learning process, continues during the interval between the first and second recalls. According to this theory the neural processes involved in learning continue to set for an interval of time after the learning period has ended, and reminiscence is due to this inertia of the nervous system as it yields to influences at the time of the second recall. Since it is a known fact that reminiscence appears simultaneously with forgetting, any theory explaining the former must also account for the latter. The theory of neural growth is inadequate in this respect, for while it accounts for the appearance of reminiscent material it does not account for material lost during the interval between the first and second recalls.

None of these theories offers an adequate explanation of reminiscence. Hunter (9), after reviewing the explanatory theories offered, states, "An adequate explanatory theory must await further experimentation."

McGeoch (11) suggests that reminiscence might be found to be in some way related to the phenomena observed by Zeigarnik (16)

in her work with complete and incomplete tasks. Zeigarnik found that incompleting tasks were recalled nearly twice as efficiently as completed tasks at the time of the immediate recall. This finding, as well as the observed desire of subjects to return to complete the interrupted tasks, is taken as evidence of the existence of a stress towards completion resulting from task incompleting. This tension, or stress towards completion, enhances the availability for recall of incompleting over completed tasks.

In discussing Zeigarnik's work Koffka (10, p. 337) points out that each task set up a tension which was relieved only when the task was executed, remaining unrelieved for interrupted tasks. It is also true that the attempted recall of all of the tasks is itself a task which sets up its own stress toward completion. Therefore, at the time of this recall in Zeigarnik's experiment two tensions exist, one directed toward the completion of each task, and the other directed toward the completion of the recall of all of the tasks. The results indicate that this latter tension is effective in recall and makes the incomplete tasks more readily available. The incomplete tasks are dominant in the recall since they are favored by these two stresses while the completed tasks are favored by only one, that stress directed toward the recall of all of the tasks. Zeigarnik (16) justifies this assumption in her discussion and shows that the actual relation of remembered incomplete and complete tasks is dependent upon the relative strength of these two vectors.

These assumptions are fundamental to the hypothesis of this experiment. It is important that: first, a tension toward completion is established by an incomplete task; second, this tension enhances the availability for recall of that task; third, the recall of all the tasks is in itself a task and is accompanied by a tension toward its completion; fourth, tensions toward completion both for the unit tasks and the recall of all the tasks reinforce each other making the memorial material more available for recall; and fifth, the relative strength of these vectors determine the actual relation of remembered incomplete and complete tasks.

THE PROBLEM

By definition, reminiscence appears after the learning process and at the time of the second recall. The first recall must result in an incomplete reproduction of the material if new, *i.e.*, reminiscent, material is to appear in the second recall. The first recall is an incompleting task in itself and sets up a tension toward completion. At the time of the second recall a new task is set and with it a new tension toward its completion. It is the hypothesis of this experiment that the appearance of reminiscent material at the time of the second recall is to be accounted for in terms of this latter tension reinforced by the persisting stress resulting from the incompleting earlier recall.

If this hypothesis is true, the available reminiscent material having the greatest stress at the time of the second recall should show the greatest reminiscence, since its stress will give relatively greater strength to the tension set up by the second recall.

Reestablishing the conditions of Zeigarnik's experiment, each subject was given twenty tasks to perform. Ten of these tasks were interrupted before completion and ten the subject was permitted to complete to his satisfaction. Immediate and delayed recalls were taken. The delayed recalls were given after intervals of two minutes, two days,¹ one week, and two weeks.

The memorial material under these conditions is of two types, the incomplete tasks differing from the complete tasks in that the former have a stress toward completion while the latter are characterized by greater organization by virtue of their completion. This difference as it is related to the interval of time between the immediate and second recalls will have a significant bearing upon the expected appearance of each of the two types of material in reminiscence.

Zeigarnik tested the assumption that with the passage of time tensions will become weakened and concluded, "... diminution of tension is not due to time as such, but depends rather upon the significant events which take place during the interval." It was

¹ The two day recall interval was chosen since several studies of reminiscence indicate that two days seems to be the optimal interval for the appearance of reminiscence: 1, 2, 15.

found that a delay of ten to thirty minutes was sufficient to eliminate the memorial advantage of unfinished tasks if exciting or distracting experience was introduced. Distracting experience during the interval resulted in a superiority of complete tasks, while no distracting experience during the interval showed incomplete tasks retaining a 50 per cent superiority over complete tasks.

Harrower (7), investigating the memorial advantage of finished and unfinished jokes, demonstrated that the organization possessed by a finished joke gave it a decided superiority in memory. Although the number of cases upon which this result was obtained is small, it is taken as evidence that with the passage of time the stable organization of a memory trace is important in determining its availability. Furthermore, and in keeping with Zeigarnik's results, the tensions toward completion of the unfinished jokes lose their effectiveness in recall with the passage of time. Koffka (10, p. 340) interprets Harrower's findings as indicating that recall depends upon the organization possessed by the trace and that the tensions of the Zeigarnik experiment are a factor which contributes to the preservation of this organization.

If this relation between tension and organization exists with the passage of time during the interval between the immediate and second recalls, then it should effect the appearance of incomplete and complete tasks in the reminiscent material.

In accordance with the earlier assumptions and the indicated relationship between tension and organization with the passage of time, the following should be expected if the hypothesis of this experiment is supported. Following the presentation of the twenty tasks the immediate recall should show the Zeigarnik effect. At the times of each of the delayed recalls both complete and incomplete reminiscent items should appear. However, changes in the relative appearance of incomplete and complete items should be expected. The second recall, given after a two minute interval during which no distracting experience is introduced, should result in a relatively greater number of incomplete reminiscent items since the tensions enhancing their availability have not been dissipated. It is a reasonable assumption that

during the other time intervals there will be sufficient distracting experience in the lives of the subjects of this experiment to expect some dissipation of the tensions of the incomplete tasks. At the same time the stable organization of the completed tasks should have their preservation contributed to by the tension set up as a result of the incomplete immediate recall. It should be expected, therefore, that the incomplete reminiscent tasks will show a relative decrease in appearance as compared with the complete reminiscent tasks. The complete reminiscent tasks should show little or no decline in appearance as reminiscent items as the interval between the immediate and second recalls is increased to two weeks. The direction of this relative change should appear in the results of the two day and one week recalls.

If these predictions are confirmed then the results will support the hypothesis that the tension of the second recall, reinforced by the persisting stress of the first recall, accounts for the appearance of reminiscent material.

SUBJECTS

Two hundred young men selected from those attending an industrial school for delinquents served as subjects. The entire school population had previously been given the Revised Stanford-Binet Scale for Measuring Intelligence, Form L, and the subjects for this experiment were selected at random from those obtaining an intelligence quotient of 80 or above. Table I gives the median, mean, and standard deviation for the chronological ages, mental

TABLE I
GROUP MEASURES

		Total Group	Group I	Group II	Group III	Group IV
C.A.	Median	18.7	19.2	18.3	18.7	18.5
	Mean	19.0	19.5	18.6	18.9	18.9
	S.D.	2.50	2.39	1.93	1.78	2.06
M.A.	Median	15.2	15.4	15.1	15.2	15.2
	Mean	15.5	15.6	15.4	15.5	15.4
	S.D.	1.47	1.44	1.50	1.59	.44
I.Q.	Median	101.4	102.3	100.4	101.5	101.5
	Mean	102.8	103.3	102.8	103.2	102.2
	S.D.	2.16	2.03	2.28	2.23	2.11

ages and intelligence quotients for the total group of subjects and for each experimental group.

The significance of the differences (4, p. 114) between the group measures given in Table I was investigated and the findings are shown in Table II. Only the results of the comparison of the mean chronological ages for the groups and the comparison of the mean mental ages for the groups are shown. The table gives the critical *t* and the probability that the observed differences would occur by chance.

TABLE II
COMPARISON OF GROUP MEASURES
Chronological Ages

	Group II		Group III		Group IV	
	<i>t</i>	<i>P</i>	<i>t</i>	<i>P</i>	<i>t</i>	<i>P</i>
Group I	.337	.7	.216	.8	.202	.8
Group II			.146	.8	.479	.6
Group III					.054	.9

Mental Ages

	Group II		Group III		Group IV	
	<i>t</i>	<i>P</i>	<i>t</i>	<i>P</i>	<i>t</i>	<i>P</i>
Group I	.122	.9	.475	.6	.122	.9
Group II			.126	.9	.097	.9
Group III					.228	.8

The subjects were chosen from those boys who were living in single cells, *i.e.*, those boys who did not have cell mates. This was done to control as much as possible the probability of discussion of the experiment which would act as practice facilitating later recall. For administrative reasons within the school and beyond the control of the experimenter, this precaution was not always carried out, for boys were occasionally moved and given cell mates during the interval between the first and second recalls. The experimenter did not use as subjects any two boys who were living together at the time of their introduction to the experiment.

To reduce further the probability of discussion of the experiment the general procedure was made to appear no different from the ordinary institutional routine. On the basis of the experimenter's experience it was deemed inadvisable to ask the subjects to refrain from discussion of the experiment, for such a request is usually a signal for much discussion in the population of an institution for delinquents.

METHOD OF PROCEDURE

Part of the regular school routine included a psychological examination in the testing room of the school clinic. So that this experiment would not appear to be different from routine procedure in the school, the experimental conditions were set up in this testing room, one end of which had previously been screened off. The subject was seated at one side of a flat-top table desk and the experimenter was seated at the other side. Equipment used throughout the experiment was kept in the drawers of the desk except when in use. A stop watch was always visible, as was the record card of the experimenter.

Each subject was given the following general instructions:

"Today you are going to take some tests. I know that you can do all of these tests because they are easy. What I want to know is this: first, how fast can you do them; and second, how well can you do them. I will put the tests on the desk in front of you and explain them to you. You may ask any questions you wish. When you understand what you are to do I will say 'Go' and start this watch. Do not begin until I say 'Go.' Work as fast and as accurately as you can and when you are finished let me know so that I can stop this watch. If I say 'Stop,' and the time is up before you finish, you must stop right where you are. Do you understand? Remember, work as fast as you can and as accurately as you can."

Each subject was then given the series of twenty tasks in the order in which they are described, with the following instructions for each task:

Task 1. "Here is a board with a number of holes in it, and here is a box of nuts and bolts. You are to screw the right nut on the right bolt, like this (demonstrate), and place it over here. Screw the nut on just far enough to hold, do not waste time screwing it all the way down. Begin with the largest ones and go all the way down the board to the smallest ones (demonstrate). You will find that there are not enough to fill all of the holes so you must leave these two outside rows empty (demonstrate). Do you understand? Remember, start with the big ones, screw the nuts on just far enough to hold, work as fast as you can, and be sure to get them in the right holes. Ready? GO!"

Task 2. "Write the names of ten different kinds of trees as fast as you can. Ready? GO!"

Task 3. "Here are a number of colored cards. You are to sort these cards according to color—put each color in a separate pile. Then count the number of cards in each pile and tell me how many cards there are of each color. Do you understand? Ready? GO!"

Task 4. "Are you right handed? (Place the board accordingly, with the tray toward the hand most used.) You are to hold the tweezers in your hand like this (demonstrate) and pick up the pins like this (demonstrate) placing

one pin in each hole. You are to put one pin in each hole from this corner down to this corner, and from this corner down to this corner (demonstrate). Do you understand? Ready? GO!"

Task 5. "Count the number of circles on this card. Be sure to check your answer before telling me because the first answer given will be taken. Do not make marks on the card. Do you understand? Ready? GO!"

Task 6. "Here is a box of beads, and here is a picture of how these beads should be strung. You see, it starts with two brown ones, then a round white one, etc., etc. (pointing to the drawing on the card). You are to take this needle and thread and string these beads as they are here (point) as rapidly as you can. Do you understand? Ready? GO!"

Task 7. (Placing the constructed paper clips before the subject and handing him the seven loose paper clips) "Here are seven paper clips. You are to make one of these (point) with your paper clips as fast as you can. Do you understand? Ready? GO!"

Task 8. "Here are a number of animal drawings. Each animal has a part missing. You are to draw in the missing part and then write the name of the animal beside its picture. Do you understand? Ready? GO!"

Task 9. "You are to print your full name backwards starting with the last letter of your name. Begin over here (point to left-hand margin of paper). Do you understand? Ready? GO!"

Task 10. "Here is a picture of Donald Duck which I have colored, and here is one for you. You are to color your picture exactly as this one has been colored. Do you understand? Ready? GO!"

Task 11. "On this paper you will see several rows of capital Os and capital Cs. You are to count the number of capital Cs in each row and write the number at the end of each line (point). Then add the column and find the total number of Cs on the page. Do you understand? Ready? GO!"

Task 12. "On this paper you will find all the numbers from one (point) to thirty (point). They are scattered all over the page. You are to take your pencil and connect the numbers in order, starting with one, then to two, to three, etc. Go as fast as you can. You may cross lines or draw through numbers as you please, but be sure to connect all of the numbers in order. Do you understand? Ready? GO!"

Task 13. "In this box you will find that each of the blocks is a plain wooden block with a black dot on one side. You are to pack these blocks on the floor of this box (indicate) so that the black dots are up. Work as rapidly as you can. Do you understand? Ready? GO!"

Task 14. "Each row on this sheet has a number of symbols in it. On the first row all of the symbols are numbered from one to ten. You are to number the symbols in all of the other rows according to the way they are numbered in the first row. For example (point to several symbols as illustrations). Do you understand? Ready? GO!"

Task 15. "This is a maze or a puzzle. You are to take your pencil, beginning where it says 'Start,' and draw a line showing how you would go so as to get out where it says 'End.' You must never cross a fence and always stay in the alley ways. Do you understand? Ready? GO!"

Task 16. "Here is a box of cubes. Each cube is the same and each cube has one plain white side, one red and white side, and one plain red side (illustrate). You are to arrange the cubes on this board (indicating the box lid) so that you spell out the school initials as they are shown on this card (point). Do you understand? Ready? GO!"

Task 17. "Do this problem as quickly as you can showing all of your work. Are you ready? GO!"

Task 18. "Here is a small calendar. You are to write the names of every other month of the year, starting with January. Then find the total number of letters in the names of these months. Do you understand? Ready? GO!"

Task 19. "Here is a drawing that was made with this protractor, a pencil, and nothing more. You are to make a drawing just like it. Use only the pencil and protractor. Do you understand? Ready? GO!"

Task 20. (Following a thorough explanation of the Binet Code) "Now, I want you to translate this code message and do exactly what it tells you to do. Do you understand? Ready? GO!"

Each subject was permitted to complete ten of the twenty tasks and the other ten were interrupted before he completed them. The order of completion and incompletion was reversed for every other subject to avoid the effects of task difficulty upon the final results. The arrangement given to odd numbered subjects was called Series A, and the order given to even numbered subjects was called Series B. Both of these arrangements are shown in Table III.

The point at which an incompleted task was interrupted was

TABLE III
ARRANGEMENTS OF COMPLETED AND INCOMPLETED TASKS

	Series A	Series B
Task 1.....	C	I
Task 2.....	I	C
Task 3.....	I	C
Task 4.....	C	I
Task 5.....	I	C
Task 6.....	C	I
Task 7.....	C	I
Task 8.....	I	C
Task 9.....	C	I
Task 10.....	I	C
Task 11.....	I	C
Task 12.....	C	I
Task 13.....	I	C
Task 14.....	I	C
Task 15.....	C	I
Task 16.....	C	I
Task 17.....	I	C
Task 18.....	C	I
Task 19.....	I	C
Task 20.....	C	I

chosen by the experimenter and was decided upon when he observed that the subject was approaching the solution of the task but had not yet reached it, and when the subject's attention and interest seemed to be most intense. No explanation was given for the interruption other than the clicking of the stop watch, and the next task was quickly presented.

When the subject had ceased working on the last task he was asked a number of routine questions. The information as to where he was housed in the institution—ward, tier, and cell—as well as when he was born and his age, was recorded on the result card. Following this his particular job at the school was discussed with him and when two or three minutes had elapsed the conversation was again turned to the tasks. At this time he was asked to name as many as he could of the tasks he had just taken.

The tasks recalled, in the order of their recall, were recorded on the result card. Nothing was said to the subject during this recitation, regardless of how long he might pause, until he voluntarily stated that he could recall no more. At that time he was again engaged in a conversation about his school work and dismissed to return to his duties in the usual manner following interviews with clinic members.

Following this initial contact the subjects were divided arbitrarily into four groups. The subjects of Group I were given a second recall after a lapse of two minutes. The subjects of Group II were brought to the same testing room two days later at approximately the same time of day as originally tested. The subjects of Group III were brought to the same testing room one week later at approximately the same time of day as originally tested. The subjects of Group IV were brought to the testing room two weeks after the initial contact at approximately the same time of day as originally tested.

The subjects were treated similarly at the time of the second recall regardless of the group to which they belonged. The subjects of Group I were asked a few routine questions following the immediate recall and the answers were recorded on the result card. The experimenter then pretended to misplace the result card. After a short and apparently futile search the experimenter asked the subject to name the tasks he had just taken once more

on the supposition that the card might never be found. In this way the subject spontaneously named the tasks without gaining the impression that he was being subjected to a memory test.

At the second recall for the other groups the experimenter pretended that he had forgotten what particular tests the subject had taken and asked him if he could help by saying, "Do you remember taking some tests behind this white screen two days (one week, two weeks) ago? What tests did you take?" The subject immediately began a spontaneous recall of the tasks and these were recorded on the result card in the order given. During this second recall the experimenter continued to act as though he were grateful for the assistance in straightening out his record of the tests previously given the subject, frowning in pretense of lack of recognition of particular tasks which might be poorly described or partially confused with other tasks. In this manner each task was carefully identified by the subject in an effort to refresh the experimenter's memory.

When the subject had stated that he could recall no more tasks, he was thanked for his efforts and coöperation, and he was dismissed from the testing room to return to his school work. No explanation of the experiment was given, but when an occasional subject asked the purpose of the tasks, the real nature of the experiment was never revealed. Such subjects were satisfied with a general statement about the importance of tests for vocational guidance.

DESCRIPTION OF TASKS

The tasks used were designed to meet several specifications. It was essential that each task be sufficiently difficult to offer a challenge to every subject and at the same time not so difficult as to render it incapable of solution by any subject. Each task was constructed so that no subject could complete it mentally. The kind of performance was varied from task to task to avoid similarity as much as possible. Every task was constructed with the aim of attracting the subject's interest and required sufficient time for solution to permit concentration of attention. No task was completed in less than one minute and seldom did any subject require more than five minutes on a task. The average time spent in the solution of a task was approximately three minutes.

The following is a brief description of the tasks used:

Task 1. The subject was presented with a modification of the Assembling Task of the Detroit Manual Ability Test. The box with two compartments containing separately the nuts and bolts was placed before the subject. Beside this was placed the board with the appropriate recesses for the assembled nuts and bolts. The subject was instructed to assemble the nuts and bolts beginning with the largest, and to place them in their proper recesses.

Task 2. The subject was given a plain piece of white paper and told to write the names of ten different trees.

Task 3. A pack of 100 colored cards, well shuffled, was placed before the subject with the instructions to sort them into piles according to color and count the number of cards of each color.

Task 4. The Johnson O'Connor Finger Dexterity board, a number of brass pins, and a small pair of tweezers were used in this task. The subject was asked to place the pins with the tweezers in two diagonal rows across the square of the board.

Task 5. A piece of white cardboard, $8\frac{1}{2} \times 11$, was placed before the subject. On this cardboard were drawn a number of overlapping circles. The circles were of varying size, in black ink, and formed no definite pattern by their placement on the paper. The subject was asked to count the number of circles.

Task 6. The subject was given a small box containing a needle and thread, and a number of small colored beads. He was asked to string these beads according to a definite arrangement shown on a card placed before him.

Task 7. A construction of seven paper clips forming two adjacent squares was placed before the subject. He was then given seven paper clips and told to make a similar construction.

Task 8. One sheet of paper, $8\frac{1}{2} \times 11$, was placed before the subject. On this sheet of paper were six incomplete animal drawings which the subject was instructed to complete and then write the name of the animal beside its picture.

Task 9. The subject was given a piece of paper and a pencil and instructed to print his full name backwards, starting with the last letter of his last name at the extreme left-hand side of the page.

Task 10. The subject was shown a mimeographed picture of Donald Duck which had been previously colored with crayons. He was then given a box of assorted crayons and a plain mimeographed picture and told to crayon his picture exactly like the sample.

Task 11. The subject was given a paper on which was mimeographed eleven solid rows of capital Os and capital Cs irregularly arranged. He was told to count the number of Cs in each row and to place this number on a specified line at the end of each row. He was then to find the total number of Cs for the entire page.

Task 12. A modification of the Taylor Number Test on a paper, $8\frac{1}{2} \times 11$, was placed before the subject. The numbers ranged from one to thirty. The subject was told to connect the numbers in serial order as rapidly as possible, beginning with number one.

Task 13. Two boxes, each about the size of a cigar box, were placed before the subject. One of these boxes was empty and the other contained sufficient

small wooden cubes to cover the bottom if packed regularly. Each cube was made of plain wood except that one side had a small ink dot on it. The subject was told to pack the blocks on the floor of the empty box so that the black dots were up.

Task 14. The subject was given a piece of paper, $8\frac{1}{2} \times 11$, on which were mimeographed nine rows of symbols. Each row contained the same ten distinct symbols arranged in different orders. Under the symbols on the first row were the numbers from one to ten. The subject was instructed to number all other symbols on the page accordingly.

Task 15. A modification of the Porteus Maze for the ten year level was placed before the subject and partially covered by the experimenter's hand until it was certain that he understood the instructions.

Task 16. A cigar box, with the lid separate, containing twenty-eight Design Color Cubes was placed before the subject. He was then shown a small card on which there was a design showing how these cubes could be arranged to form the school initials in red and white. He was told to arrange his blocks to form the school initials.

Task 17. The subject was given a piece of paper and a pencil and then shown a card, 3×5 , on which was typed a short arithmetic problem involving the fundamental processes. He was told to make the calculations as quickly as possible.

Task 18. After the subject was given a piece of paper and a pencil, he was handed a small calendar on which the names of the months were written in abbreviation. He was instructed to write the names of every other month, beginning with January, and find the total number of letters in these names.

Task 19. The subject was shown a 5×7 white card on which a conventional drawing of a man's face had been made with a protractor. He was then given a protractor, a pencil, and a similar white card and told to make a drawing exactly like the sample.

Task 20. The Binet Code was shown to the subject and carefully explained. He was then given a sheet of paper on which there was a message written in code and told to translate the message and to do exactly what it told him. The translated message read, "Fold this paper in half and write your number outside."

EXPERIMENTAL FINDINGS

The Immediate Recall:

The immediate recall resulted in the appearance of I and C² tasks as shown in Table IV. This table also gives the I/C ratios for each experimental group as well as for the entire two hundred subjects. These results support Zeigarnik's findings which showed a superiority in the appearance of I over C tasks at the time of the immediate recall.

² For the sake of brevity in this paper I and C will refer to incomplete and complete tasks respectively.

The I/C ratio for each experimental group varies from that of the total group. The significance of these differences was investigated by a test for homogeneity (4, p. 94) using the method of chi square. The group ratios are not found to be significantly heterogeneous since the P value of .77 indicates that the chances are 77 in 100 that the observed differences between the I/C ratios would occur in random sampling.

TABLE IV

IMMEDIATE RECALL

Showing the I/C Ratios for Each of the Four Experimental Groups Based on the Tasks Appearing in Immediate Recall

Group	Time Intervals of Group	I Tasks	C Tasks	I/C Ratio
I	Two Minutes	234	152	1.54
II	Two Days	251	151	1.66
III	One Week	255	159	1.60
IV	Two Weeks	224	136	1.65
	Total	964	598	1.61

TABLE V

ANALYSIS OF I AND C TASKS REMINISCED AND NOT REMINISCED AT THE SECOND RECALL

Task	Group I (2 min.)						Group II (2 d.)					
	Number		Number Not		Chi Square	Star	Number		Number Not		Chi Square	Star
	Reminiscd		Reminiscd				Reminiscd		Reminiscd			
	I	C	I	C	I	C	I	C				
1	4	1	1	3	2.740		2	3	0	2	1.134	
2	2	5	8	13	.207	*	6	6	9	11	.0751	
3	5	5	14	17	.0709		2	6	20	18	2.021	*
4	7	10	6	7	.0737	*	3	8	6	8	.649	*
5	3	4	13	15	.0287	*	5	6	6	16	1.046	
6	6	4	7	11	1.147		2	2	3	5	.173	
7	9	2	12	21	6.830		3	4	18	20	.0476	*
8	4	4	8	13	1.222		3	11	11	11	2.9407	*
9	8	4	11	15	.275		5	12	15	10	3.795	*
10	6	4	2	9	3.902		5	8	3	6	.0613	
11	9	4	9	16	3.797		0	3	14	20	1.989	*
12	4	5	18	18	.1705	*	4	2	19	22	.868	
13	6	6	0	6	4.500		1	7	3	11	.432	*
14	4	5	12	19	.0838	*	1	4	12	18	.7306	*
15	8	2	14	21	5.114		5	5	16	16	.000	*
16	1	3	1	18	.415		2	11	3	1	5.268	*
17	5	5	3	5	.2809		7	5	6	5	.0327	
18	9	11	9	13	.0703		2	3	14	16	.0762	*
19	7	8	9	12	.0518		2	6	9	11	.961	*
20	3	8	3	2	1.573	*	0	10	1	0	2.790	*

The Second Recall:

This experiment is concerned with reminiscent material only; and only the findings of the second recall which pertain to reminiscence will be presented.

The tasks which did not appear in the immediate recall constitute the tasks available for reminiscence. Table V analyzes the data of the experiment for each of the twenty tasks. The first column indicates the number of the task. The remainder of the table is composed of four major divisions, each division dealing with the results of one of the four experimental groups. The first two columns of each division report the number of Ss reminiscing each I task and each C task. The second two columns report the number of Ss who did not reminisce each I task and each C task. The fifth column of each division of the table gives the chi square value for each task expressing the dependence between the number reminisced and the number not reminisced on the one hand, and on the other hand whether or not the task was I or C. In the last column of each division of the table a star is placed after each chi square where the direction of the

TABLE V—Continued

Task	Group III (1 wk.)						Group IV (2 wk.)					
	Number		Number Not		Chi	Star	Number		Number Not		Chi	Star
	Reminisced		Reminisced				Reminisced		Reminisced			
	I	C	I	C	Square	I	C	I	C	Square		
1	4	2	2	4	1.332		3	5	1	5	.731	
2	3	6	6	11	.00907	*	6	7	7	11	.161	
3	2	4	19	20	.494	*	3	3	20	21	.00324	
4	5	10	12	19	1.994	*	10	12	10	9	.212	*
5	4	6	10	11	.154	*	7	4	10	15	1.712	
6	2	8	4	2	3.484	*	7	3	4	6	1.818	
7	6	8	16	16	.198	*	4	9	18	15	2.109	*
8	3	3	10	15	.2003		4	2	15	19	1.0397	
9	3	6	13	14	.599	*	3	6	18	18	.803	*
10	3	9	4	11	.0103	*	3	6	1	6	.761	
11	3	4	12	20	.0652		1	4	16	20	1.0849	*
12	2	3	18	19	.135	*	1	0	18	24	1.292	
13	2	10	3	7	.557	*	2	8	6	8	1.375	*
14	1	1	19	22	.00905		1	5	19	19	2.318	*
15	2	3	13	18	.00682	*	2	5	15	16	.912	*
16	0	4	0	3	.000	*	0	4	2	5	1.393	*
17	1	3	2	6	.000	*	0	5	7	11	.673	*
18	0	6	20	17	6.008	*	1	4	20	18	1.893	*
19	4	1	9	15	3.0137		0	2	8	17	3.667	*
20	1	4	2	0	2.766	*	1	4	2	3	.476	*

dependence is such that the number of Is appearing in reminiscence is equal to or fewer than the number of Is expected by chance.³

It will be observed that in Group I fourteen out of the twenty tasks show dependence between status of the task, *i.e.*, whether it is I or C, and whether or not it was reminisced, in the direction required by the hypothesis that I tasks tend to be reminisced and C tasks not reminisced at the two minute recall. The probability of this discrepancy being significant is .96.⁴ When the fourteen tasks are studied it develops that chi square is 30.416, which for N equals 14, yields a P value of less than .01.⁵ From this it may be concluded that the departure from chance in the direction indicated by the findings of these fourteen tasks is sufficiently large to meet the most rigorous criterion of reliability. Furthermore, it will be noted from the starred tasks that the maximum chi square is 1.573 and that the sum of the chi squares for these tasks is 2.138. Such a chi square yields a P value of .45, which must be interpreted as meaning that those tasks which do not support the direction of dependence exhibited by the majority of the tasks depart to such a small extent in the opposite direction that their results can not be interpreted as significantly departing from the group findings.

In the case of Group II there are thirteen tasks in which the direction of dependence favors the appearance of C tasks. When these tasks are studied chi square is shown to be 22.703, which returns a P value of less than .03. From this it may be concluded that in the case of these thirteen tasks it is generally true that more C than I tasks are reminisced at two days. If the remaining

³ For the method of calculation of this expectation see 4, pp. 88-89.

⁴ This probability may be ascertained by applying the formula $\sigma_F = \sqrt{pqn}$ to the chance expectation that 10 tasks would reflect the direction of dependence and 10 tasks would not. The ratio of the difference between 10 and 14 to the σ_F may be interpreted by reference to 5, p. 213, Table 34.

⁵ The P values obtained from Fisher's table of chi square take into consideration the probability of a departure from independence in both directions and in view of the fact that this paper is interested in the departure from independence in only one of the two possible directions, the P values found in Fisher's table have been halved. In many instances the chi squares reported were sufficiently large to yield a P value of less than .01 before the division was made.

seven tasks are studied chi square is found to be 3.392. The corresponding P value for this chi square is .42. From this fact it may be concluded that even in these seven tasks which reflect a tendency in the direction of dependence different from that observed in the majority of the tasks, the magnitude of this observed tendency in the seven tasks is not sufficient to warrant a general conclusion that I tasks tend to be reminisced and C tasks not reminisced.

In the case of Group III there are fifteen tasks in which more C tasks than I tasks are reminisced. The chi square for these tasks is 16.503 for which the P value is .17. From this fact it may be concluded that in the case of these fifteen tasks there does not appear to be more than a tendency in the direction favoring the appearance of C tasks in reminiscence. However, if the formula $\sigma_F = \sqrt{pqn}$ is applied to the number of tasks favoring this direction it will be observed that the probability of fifteen out of twenty tasks occurring by chance in the direction indicated is only .01. Furthermore, in the case of the five tasks indicated in the table by not being starred there are more I tasks than C tasks reminisced and the sum of their chi squares is 4.620. The P value corresponding to this chi square is .23, from which it may be concluded that the discrepancy in the case of these five tasks is not sufficient to support the conclusion that more I tasks are reminisced than C tasks, even in the five cases not consistent with the main findings of the group. It therefore can be concluded that there is a tendency for C tasks to be reminisced and for I tasks not to be reminisced at one week.

Group IV contains twelve cases in which more C tasks than I tasks are reminisced. These twelve tasks yield a chi square of 16.921 to which corresponds a P value of less than .01, from which it may be concluded that for these tasks it is generally true that more C tasks than I tasks are reminisced at two weeks. For the remaining eight tasks, indicated in the table by not being starred, there are more I than C tasks reminisced. The sum of the chi squares for these eight tasks is 7.521. The corresponding P value for this value of chi square is .24, from which it may be concluded that among the tasks showing a departure in a

different direction from that observed in the main trend of the findings of the majority of tasks, this departure is not large enough to warrant a conclusion contradictory to that of the main findings. It may be concluded in this case again that the main tendency of the data of Group IV supports the conclusion that more C tasks than I tasks are reminisced at two weeks.

The outcome of the foregoing analysis of the data by task warrants the conclusion that the data obtained for each group is relatively homogeneous and that all data from each group can be treated as a composite without endangering the conclusions.

Table VI gives the results of the experiment considering the tasks used to be entirely homogeneous. The first column identifies the groups used while the second column gives the time interval elapsing between the immediate and second recalls for each group. The third and fourth columns report the I and C tasks respectively available for reminiscence. Columns five and six give the number of I and C tasks respectively which were reminisced, while columns seven and eight give the chance expectation of I and C tasks reminisced. In columns nine and ten are reported the number of I and C tasks respectively which were not reminisced, while columns eleven and twelve report the chance expectations of I and C tasks respectively which were not reminisced. Column thirteen gives a value of chi square for the dependence between the status of the task on the one hand, *i.e.*, whether it is I or C, and on the other hand whether or not it was reminisced. Column fourteen reports the probability value appropriate to the value of chi square found in the previous column.

Examination of Table VI confirms the results of the examination of Table V. Again it is evident that in the case of Group I there appears to be a marked tendency for I tasks to be reminisced and for C tasks not to be reminisced. This fact is shown by a comparison of the observed and expected frequencies of I and C tasks reminisced and not reminisced. Statistical treatment of the data by the method of chi square develops the fact that the probability for this observed discrepancy from chance dependence between the status of the task, *i.e.*, whether it is I or C, and whether or not it will be reminisced, is less than .01. This P

TABLE VI

ANALYSIS OF THE DATA OF THE SECOND RECALL AFTER TESTING THE STATISTICAL HOMOGENEITY OF THE TASKS OF EACH OF THE EXPERIMENTAL GROUPS

Group	Time Interval of Group	Task Available for Reminiscence		Tasks Reminiscenced		Chance Expectation of Tasks Reminiscenced		Tasks Not Reminiscenced		Chance Expectation of Tasks Not Reminiscenced		Chi Square	P
		I	C	I	C	I	C	I	C	I	C		
I	Two Minutes	266	348	106	104	91	119	160	244	175	229	6.630	.01
II	Two Days	249	349	60	122	76	106	189	227	173	243	8.315	.01
III	One Week	245	341	51	101	64	88	149	240	181	253	6.163	.013
IV	Two Weeks	276	364	59	98	66	91	217	266	210	273	1.692	.095

value meets Fisher's most rigorous criterion for the establishment of dependence and it can therefore be concluded that there is a marked tendency for I tasks to be reminisced and for C tasks not to be reminisced in Group I.

Further examination of Table VI discloses the fact that quite the contrary is true in the case of Groups II, III, and IV. By comparing the appropriate columns giving the observed and expected I and C tasks reminisced and not reminisced for each of the Groups II, III, and IV, it is evident that there is a marked tendency for I tasks not to be reminisced and for C tasks to be reminisced. The P values, with one exception, meet Fisher's criterion for the establishment of dependence and justify the conclusion that in groups II and III, at least, there is more likelihood for C tasks to be reminisced and for I tasks not to be reminisced. In the case of Group IV the tendency exists but does not exhibit a satisfactory degree of statistical reliability. It should be noted, in addition, that the direction of dependence observed in the case of Groups II, III, and IV is the same.

From Table VI it may be seen by inspection that a definite change in the direction of dependence has taken place between that exhibited in Group I and that exhibited in Groups II, III, and IV. This observation is subject to one qualification. It is observed from Table VI that the number of I and C tasks available for reminiscence in the various groups is not the same, and that furthermore the proportion of tasks available which are I tasks is not the same for all groups. In Group I 43.3 per cent of the tasks available for reminiscence are I tasks, in Group II 41.6 per cent are I tasks, in Group III 41.8 per cent are I tasks, while in Group IV 43.1 per cent are I tasks.

Further study of Table VI reveals an interesting fact relative to the appearance of I and C tasks in reminiscence from group to group. Considering only the I tasks reminisced in each of the groups it is evident that of those available for reminiscence in each group approximately 40 per cent were reminisced in Group I, 24 per cent in Group II, 21 per cent in Group III and 21 per cent in Group IV. These figures show a steady decline in the appearance of I tasks from Group I to Group IV. Considering only

the C tasks reminisced in each of the four experimental groups it is evident that of those available for reminiscence in each group approximately 30 per cent were reminisced in Group I, 35 per cent in Group II, 29 per cent in Group III, and 27 per cent in Group IV. These figures show that at the two day recall there is an increase in the relative appearance of C tasks over that of two minutes, after which there is a gradual but less rapid decline than that observed for I tasks at the one week and two week recalls.

In order to establish expectations for numbers of I and C items occurring in each of any two groups in the data the following procedure was used. First, the number of I and C tasks *available* for reminiscence in the case of each of the groups were entered into a 2×2 table. This was done in order to determine the value of chi square obtained by comparing the observed frequencies of the items *available* for reminiscence with those frequencies which would have been observed had there been no statistical dependence between the two groups, *i.e.*, whether two minute or two week, and the status of the task, *i.e.*, whether I or C in the tasks *available* for reminiscence. This chi square yielded a measure of dependence in the tasks which was present before reminiscence was permitted. A second 2×2 table was established, plotting the same two groups against the status of the task. This time, however, the data entered consisted in the number of tasks of each description actually reminisced. Next, an expectation was calculated for each cell of this second table which yielded, on the conventional treatment, exactly the chi square obtained on the first 2×2 table. These expectations represent what was to be expected in the second of the two tables if only that degree of dependence between status of the task and groups observed in the first table was present in the items reminisced. Finally the observed frequencies shown in Table VI were compared with the theoretical frequencies, the calculation of which has just been described, and the chi square was calculated and its corresponding P value found. The P value was interpreted to give the probability that any dependence observed between groups and the status of the task in

reminiscence *exceeded* that which was to be expected on the basis of the dependence among the items available for reminiscence.

In Table VII the change in dependence from group to group is studied. The first column reports the two groups being studied. Columns two and three give the observed I reminiscent items and the observed C reminiscent items respectively which appear in the first of the two groups reported in column one. Columns four and five give the expected I reminiscent items and the expected C reminiscent items for the first of the two groups reported in column one. Columns six and seven give the observed I reminiscent items and the observed C reminiscent items for the second of the two groups reported in column one, while columns eight and nine give the expected I reminiscent items and the expected C reminiscent items for the second of the two groups reported in column one.

Examination of Table VII reveals that there is little probability that the change in the relative appearance of I and C reminiscent tasks between Group I and any of the other three groups would occur by chance. The probability of these observed changes occurring in a random sample is less than .01. There is, however, every likelihood that the differences in the relative appearance of I and C reminiscent tasks between Group II and Groups III and IV would occur by chance. It is also true that there is every likelihood that the changes observed between Groups III and IV would occur in a random sample. It is evident from these findings that whatever significant change occurs in the relative appearance of I and C tasks in reminiscence from group to group occurs after the two minute recall and before the two day recall. It is also evident that the change appearing at the two day recall persists with little or no alteration through the one week recall and until the two week recall. It has already been shown that at the two minute recall more I tasks than C tasks appear in reminiscence and that at the two day, one week, and two week recalls more C tasks than I tasks appear in reminiscence. The findings of Table VII support the conclusion that the reversal in the relative superiority of I and C reminiscent tasks between the two minute and each of the other recall groups has little or no likeli-

TABLE VII
STUDY OF THE CHANGE IN DEPENDENCE OF REMINISCENCE UPON INCOMPLETION FROM EXPERIMENTAL GROUP TO EXPERIMENTAL GROUP

Groups Compared (A with B)	A				B				Chi Square	P
	Observed Reminiscent Tasks		Expected Reminiscent Tasks		Observed Reminiscent Tasks		Expected Reminiscent Tasks			
	I	C	I	C	I	C	I	C		
I with II	106	104	92	118	60	122	74	108	8.253	.005
I with III	106	104	93	117	51	101	64	88	7.821	.005
I with IV	106	104	95	115	59	98	70	87	5.443	.009
II with III	60	122	60	122	51	101	51	101	.000	.500
II with IV	60	122	61	121	59	98	58	99	.0518	.41
III with IV	51	101	52	100	59	98	58	99	.0565	.40

hood of appearing by chance and that the observed change from group to group is statistically significant.

Summary of Experimental Findings:

Summarizing the analysis of the results given in Tables V, VI, and VII it has been demonstrated that:

1. At the two minute recall there are relatively more I tasks than C tasks reminisced.
2. At the two day recall there are relatively more C tasks than I tasks reminisced.
3. The tendency for relatively more C tasks than I tasks to be reminisced persists at the one and two week recalls.
4. The I reminiscent tasks show a gradual decrease in appearance from the two minute recall to the two week recall, while the C reminiscent tasks show a sharp increase in appearance at the two day recall followed by a gradual but less rapid decline than that observed for the I tasks at the one week and two week recalls.

DISCUSSION AND CONCLUSIONS

Reestablishing the conditions of the Zeigarnik experiment, each of the two hundred Ss was given twenty short tasks to perform, ten of which he was permitted to complete and ten of which were interrupted before completion. An immediate recall was taken and the results yielded the Zeigarnik effect giving a group I/C ratio of 1.60. The Ss were then divided into four groups of fifty Ss each and each group was given a second recall after two minutes, two days, one week, and two weeks respectively. In each of the second recalls both I and C tasks appeared in the reminiscent material.

The treatment of the results of the experimental groups was undertaken after an investigation into the homogeneity of the results of each group. Analyzing each set of group results by task, it was discovered that at the two minute recall there are more I tasks and considerably fewer C tasks reminisced than are to be expected by chance. At the two day recall, however, there is a marked tendency for C tasks to be reminisced and for I tasks not to be reminisced when compared with chance expectation. This

superiority of C tasks in reminiscence continues in the results of the one week and two week recalls. In each group a minority of tasks yielded data which were not consistent with the tendency observed in the data of the group as a whole. However, the tendency of these non-conforming cases was not sufficiently strong to warrant a contradiction of the conclusions justified by the group data as a whole. The analysis of the group results justifies the conclusions as to the homogeneity of each set of group results.

Comparison of the results from group to group shows that while there is a marked tendency for I tasks to be reminisced and for C tasks not to be reminisced at the two minute recall, this relationship is reversed at the time of the later recalls when decidedly more C tasks than I tasks appear in the reminiscent material. This change in the relative appearance of I and C reminiscent tasks from Group I to the other three experimental groups is extremely unlikely to appear by chance.

It is to be recalled that the development of the hypothesis of this paper is based upon several assumptions. These are: first, a tension toward completion is established by an incomplete task; second, this tension enhances the availability for recall of that task; third, the recall of all the tasks is in itself a task and is accompanied by a tension toward its completion; fourth, tensions toward completion, both for unit tasks and the recall of all the tasks, reinforce each other making the memory material more available for recall; and fifth, the relative strength of these vectors determines the actual relation of remembered incomplete and complete tasks.

Reference has also been made to the work of Zeigarnik (16) from which it was concluded that with the passage of time tensions become weakened and lose their effectiveness for recall. Evidence has been cited to support the statement that time as such does not account for this dissipation of stresses but rather the introduction of distracting experience into the lives of the Ss between the first and second recalls. The work of Harrower (7), dealing with the memorial advantage of finished and unfinished jokes, was presented in evidence of the interdependence of stress and organization and in evidence of the effectiveness of organiza-

tion for the recall of C items following the dissipation of the stresses favoring the recall of I items.

The results of this experiment confirm the conclusion of Zeigarnik that I tasks appear more frequently than C tasks in the material of the immediate recall. Zeigarnik contended that this superiority of I over C tasks is the result of two vectors deriving from two tensions; one directed toward the recall of all the tasks and the other toward the completion of the task itself.

The superiority of the I tasks in the reminiscent material of the two minute recall group is accounted for in this experiment in terms of these two vectors as they reinforce the new stress directed toward the completion of the second recall. At the time of the immediate recall the I tasks are characterized by their tensions toward completion while the C tasks are characterized by the organization resulting from their completion. The stress toward the completion of the immediate recall results in the appearance of both I and C tasks in the material of the immediate recall.

While the I tasks had accruing to them these two stresses the C tasks had only one, that of the incomplete immediate recall. The interval between the immediate recall and the two minute recall was sufficiently short to permit the persistence of these two tensions and no distracting experience was introduced to effect their dissipation. At the two minute recall a new tension is introduced and directed toward the completion of this recall. At this time both I and C items appear in reminiscence because each is aided by this tension reinforced by the persisting tension of the incomplete immediate recall. The I items are dominant in their appearance as reminiscent material because they are aided by the extra persisting stress resulting from task incompleteness, while the C items were not favored by this stress.

During the intervals between the immediate and second recalls of the two day, one week, and two week groups the Ss were exposed to the distracting experience of every day life, which in a correctional institution is particularly intense. This exposure resulted in some dissipation of the stresses accruing to both the I and C items available for reminiscence at the delayed recalls. In

the case of the I items, these tensions were at least partially dissipated resulting in a marked decrease in the appearance of I reminiscent items at the two day, one week, and two week recalls. On the other hand, the C items, characterized by the organization resulting from their completion, have their availability enhanced by the stress accruing to them, as Koffka (10, p. 340) explains in his interpretation of Harrower's results. For this reason C items gain a decided advantage over I items in the reminiscent material of the two day, one week, and two week recalls and tend to decrease less rapidly than the I items with the passage of time from two days to two weeks.

The analysis of the results given in Table VI revealed an interesting relative appearance of I and C reminiscent items from group to group. Considering only the I items reminisced it was shown that their percentage of the I items available for reminiscence in each of the four groups was 40 per cent, 24 per cent, 21 per cent, and 21 per cent, progressively. At the same time C reminiscent items showed a percentage appearance of 30 per cent, 35 per cent, 29 per cent and 27 per cent for each of the four groups from I to IV in order. The regular decline in the appearance of the I reminiscent items has been explained by the gradual dissipation of their stresses with the increase in the time interval between the immediate and second recalls and the resulting increased exposure to distracting experience. The less rapid decline in the appearance of C reminiscent items from group to group and their resulting superiority over I items in the reminiscent material in Groups II, III, IV has been accounted for as due to their inherent organization and the contributions of their accruing stresses to the preservation of this organization.

The marked increase in the appearance of reminiscent C items at the two day recall is what is to be expected in consideration of the gestalt theory underlying the relationship of process and trace as developed by Koffka (10, pp. 566-567). He points out (10, p. 554) that when a process occurs in a field it is influenced by that field, and that by virtue of the law of action and reaction the field is also influenced by the process. It is evident, therefore, that if a trace forms a part of a field it will be influenced by the

occurrence of a process in that field. In this experiment an attempted recall is a process and the field is composed of the traces of the I and C items available for reminiscence. At the two minute recall the stresses favoring the availability of the traces of the I items are sufficiently strong to result in the appearance of more I than C reminiscent items. When the interval of time is increased from two minutes to two days, the stresses favoring the I items undergo dissipation while those accruing to the organized C traces have contributed to this organization and have made the C items the stronger field components. With the attempted two day recall process the field influence is in the direction of the stable C traces. Because of the law of action and reaction the mutual interdependence between the stable C items of the field and the already biased recall process becomes stronger and gives additional favor to the appearance of the C reminiscent items at the two day recall.

The traces of the C items of this experiment are assumed to possess organization by virtue of task completion and this organization is in itself of only relative stability in comparison to the traces of a fixed skill, for example. Koffka (10, p. 555), in discussing traces of questionable stability, points out that unstable traces, before they disintegrate, tend to change in the direction of greater stability. The application of this phase of the theory of memory traces and the theoretical interdependence between trace and process accounts for the marked increase in the appearance of C reminiscent items at the two day recall.

With the increase of the time interval between the immediate and second recalls from two days to two weeks the appearance of C reminiscent items shows a decrease. With the extension of this time interval the traces of the C items have theoretically reached the maximal point in their change toward greater stability and have already begun to disintegrate. Also, with the increase in the time interval and the resulting exposure to the distracting experience, the stresses contributing to the organization of the C items tend to dissipate and their decreased availability is reflected in their decreased appearance as reminiscent items. Furthermore, with less enhanced organization, the effect of the old traces upon

the new process of the delayed recall is weakened and still further accounts for the decreased appearance of C items in the reminiscent material of the one week and two week recalls.

It is to be observed also that the relative appearance of I and C reminiscent tasks remains about the same in the findings of Groups II, III and IV. The C tasks retain their relative superiority over I tasks as reminiscent material and any changes in this superiority among these three groups has every likelihood of occurring by chance. These results support Zeigarnik's conclusion that time, as such, does not account for the difference in the appearance of I and C tasks.

The results of this experiment indicate that the summative effect of tensions is reflected in the appearance of I reminiscent tasks at the two minute recall; that the availability of the C tasks at the two day recall is enhanced by the persisting stress of the incomplete immediate recall as it contributes to the preservation of the organization of these traces; that the interaction between trace and process still further enhances the availability of the traces most dominant in the field because of their stresses, and that time as such does not account for the dissipation of stresses but rather the distracting experience introduced between the immediate and second recalls. In view of these observations it is evident that the available reminiscent material having accruing to it the greatest persisting stress at the time of the second recall showed the greater appearance in reminiscence. At the two minute recall the stress of the second recall is reinforced, for the I tasks, by two persisting stresses which were not dissipated; while for the C tasks there was only one persisting stress, that of the incomplete immediate recall. At the second recall of the two day group the two stresses previously persisting were dissipated by intervenient distracting experience, losing their effectiveness in reinforcing the stress of the attempted second recall and resulting in a decrease in the appearance of I reminiscent items. At the same time the organization possessed by the C tasks had its availability contributed to by the stress of the incomplete immediate recall and resulted in a decided increase in C reminiscent tasks which show a superiority over I reminiscent tasks at the time of the two day recall. This

relative superiority of the C tasks in reminiscence was maintained as the time interval increased from two days to two weeks since the tensions favoring the I tasks tended to dissipate more rapidly from exposure to the distracting experience than those favoring the appearance of C tasks because these latter tensions accrued to the relatively stable organization of the C tasks themselves. It is evident, therefore, that the material most favored in reminiscence was of the type, which at the time of the second recall, had accruing to it more stress reinforcing the stress of the attempted second recall.

The results of this experiment support the hypothesis that the tension of the second recall, reinforced by the persisting stress of the first recall, accounts for the appearance of reminiscent material.

THE HYPOTHESIS, GESTALT THEORY, AND REMINISCENCE

It is the purpose of this section to demonstrate the general application of the theory of reminiscence developed in this paper, supported by the gestalt theory of memory traces, to the major conditions reported in the literature as conditioning the appearance of reminiscence.

It has already been stated that the surveys of the experimental studies of reminiscence (3, 11) point to the meagerness of our knowledge and question the justification for the conclusions reached by the several investigators. There is, however, sufficient evidence to indicate that the following may be true: (1) Reminiscence is proportionate to the meaningfulness of the material used (1, 6); (2) Reminiscence is more easily observed in children (1, 15); (3) Reminiscence varies inversely with the subject's general mental equipment (1); (4) The length of the time interval between the first and second recalls conditions the appearance of reminiscence (2, 11, 15); and (5) A special effort to recall results in more reminiscence (1).

1. *Reminiscence is proportionate to the meaningfulness of the material used.* The material used, regardless of its nature, is first subject to the learning process. Learning is defined by gestalt theory (10, p. 544) as consisting in the creation of trace systems

of a particular kind, in the consolidation of these, and in the making of them more and more available both in repeated and in new situations. If the memory material is such as to make difficult any step in the process of learning, the result will determine the availability of the traces which will be reflected eventually in the material appearing in reminiscence.

The difference in the facility with which meaningful and meaningless material is learned has been considered (10, p. 569) as due, not to differences in the number and kind of associations, but rather to a difference in kind of organization. The learning of a series of nonsense syllables is made difficult, for example, because the sequence of homogeneous terms interferes with the establishment of traces by robbing these traces of their individuality. In this connection the work of Restorff (12) clearly shows that it is this homogeneity rather than the nonsense character which chiefly accounts for the refractoriness of nonsense material. According to this explanation the nature of the material affects reminiscence, not by virtue of its meaning or lack of meaning, but rather by virtue of its organization as this affects the establishment of the traces. The availability of the traces, which is determined by their organization, will determine whether or not they will result in reminiscent material.

2. *Reminiscence is more easily observed in children.* Zeigarnik reported in her experiment that the memorial advantage of unfinished tasks averaged 150 per cent in the case of children while for adults the advantage favoring unfinished tasks was only 90 per cent. This difference is explained as due to the difference in attitude of the subjects. For the "very staid adults" the results show a memorial advantage of 10 per cent ($I/C=1.1$) while "its value for 'child like' subjects was 190 per cent ($I/C=2.9$)" (16, p. 84). The children were described as entering into the experimental situation whole-heartedly and accepting the necessity for completing each task as more nearly a "real need" while for the adults completion merely represented a "quasi-need".

Needs are states of tension which persist until they are relieved. The tensions back of real and quasi-needs are qualitatively the same but are more intense for the former. Real needs are more

fundamental and vital to the individual, generally having the connotation of "instinct" while quasi-needs are those involving volitional consent and result from purpose or intention. Quasi-needs are more frequent and less stable and therefore substitute satisfactions may establish equilibrium more readily than for real needs. The theory of psychical tensions proposes that with the development of the individual there is an increasing relative isolation of the tense psychical systems of these tensions. Usually there is established a rigidity of boundaries for the systems so that, for most adults, each system tends to require a specific mode of discharge for satisfaction of the tension.

It is considered that children are more likely to approach the event of learning memory material as more nearly a real need to be satisfied. The resulting trace, therefore, has accruing to it a strong stress. For the adult, the mastery of the memory material is merely a quasi-need and the tensions of the resulting stresses are of less intensity. Therefore, according to the theory, the availability of the traces is different, depending upon their identification with real or quasi-needs, which in turn have tensions of different degrees of intensity. With this interpretation, the observed differences in reminiscence between children and adults reduces itself to a matter of differences in the availability of traces due to the differing intensities of accruing tensions. This interpretation accounts more satisfactorily for the experimental findings and is suggestive of the reason why some investigators found it difficult to obtain reminiscence in adults while others obtained the phenomenon. The differences apparently lay in whether or not the subjects experienced the tasks set before them as real or quasi-needs. The conditioning factor, it would appear, is not age as such, but rather the nature and structure of the trace and tension systems characteristic of different age levels but not necessarily peculiar to those age levels.

3. *Reminiscence varies inversely with the subject's general mental equipment.* It is integral to the entire theory of memory traces that the total field, both as to process and trace, is organized into Ego and environment, and that these two systems are dynamically dependent parts of the whole system (10, p. 608). An

elaboration of this statement is not feasible in this paper for it would entail an account of the entire theory of memory traces. However, the theory contends that the Ego system is composed of a number of sub-systems which do not exist side by side but are organized in various ways, one of which is surface-depth organization. The Ego is described as having a core, the Self, and enveloping this core, in various communications with it and each other, are other sub-systems, comparable to layers. The outer layers of the surface are easily reached and most easily discharged. Although this is but one way in which the Ego is organized, the development of this organization is treated as synonymous with mental development (10, pp. 547-548). The occurrence of processes and the resulting formation of traces in differing integral complexities results in the raising of the intellectual level of the organism.

If then, we consider mental equipment as determined by the development of the Ego system, the differences between subjects of differing mental ability are reduced to differences in the complexity of their Ego systems. The development of relatively isolated tense psychical systems, previously described as typical of adults, would be associated with increased mental development. It has already been stated that the boundaries between these tense systems result in greater rigidity requiring specific modes of discharge for the establishment of equilibrium in any one tense system. For children and individuals of limited mental development this rigidity would be less, so that less specific modes of discharge would be necessary for the satisfaction of the needs of the individual. The problem then, of the relationship between reminiscence and mental development is explainable in terms of the complexity of the organization of these tense systems of the individual. A person of limited mental ability, besides being more likely to enter into the task of learning as a genuine need to be satisfied, has a less complex Ego system and therefore a more accessible Self system. The traces would therefore be expected to have their availability contributed to by the tensions arising as a result of this proximity to the Self system. The greater reminiscence for these subjects is again the result of the greater result-

ing tension accruing to the traces of the material available for reminiscence.

4. *The length of the time interval between the first and second recalls conditions the appearance of reminiscence.* In the discussion of the findings of Table VII of this paper and the interpretation of the marked increase in the appearance of C reminiscent items at the two day recall period, reference was made to the important interdependence of new processes and old traces. It has been pointed out that the nature of this interdependence may be effected by both the process and the trace. The explanation of the relation between reminiscence and the time interval between the first and second recalls is, in all probability, to be understood in terms of this interdependence. It is conceivable that the relationship between process and trace will be effected by a variety of concomitant conditions such as the nature of the material, the availability of the trace as a field component, and the nature of the need to be satisfied by the completion of the process. Further experimentation is indicated before the time interval as such can be accepted as a conditioning factor in the appearance of reminiscence.

5. *A special effort to recall results in more reminiscence.* A special effort to recall, as contrasted with a casual recall, indicates a greater intent upon the part of the subject. The stronger the intent the greater the experienced need to complete the recall and therefore the stronger the tension directed toward the completion of the recall of all of the material. This stronger tension would result, through the law of action and reaction applied to the relationship between process and trace, in an effect upon the availability of the traces. The availability of the traces of the possible reminiscent material would be enhanced by a special effort to recall, since this attempt would be accompanied by a greater tension.

Other investigations of reminiscence have yielded facts which, as has already been shown, are open to question. The theories which have been developed about these facts have been shown to possess weaknesses in application to one or another of the conditioning factors of reminiscence reported in the literature. As a

general explanatory principle, the theory developed in this paper is supported by the specific test of this experiment and has been shown to explain the observed phenomena of reminiscence reported in the literature more completely than any of the other theories so far proposed.

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